



(11) **EP 1 741 832 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.01.2007 Bulletin 2007/02

(51) Int Cl.:
E01F 9/018^(2006.01)

(21) Application number: **06116698.9**

(22) Date of filing: **06.07.2006**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**
Designated Extension States:
AL BA HR MK YU

(71) Applicant: **ALCOA NEDERLAND B.V.**
5151 RW Drunen (NL)

(72) Inventor: **van Boxtel, van Sebastiaan Johannes
Matheus**
5492 JK, St-Oedenrode (NL)

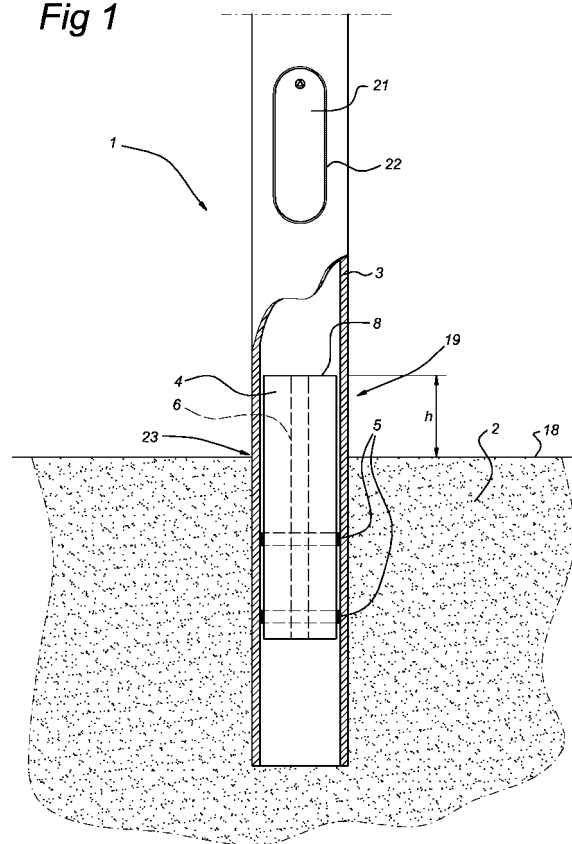
(30) Priority: **06.07.2005 NL 1029445**
31.01.2006 NL 1031041

(74) Representative: **van Westenbrugge, Andries**
Nederlandsch Octrooibureau
Postbus 29720
2502 LS Den Haag (NL)

(54) **Traffic-safe pillar**

(57) A traffic-safe pillar (1) has a reduced resistance to collisions and comprises a post (3) to be anchored with respect to a positioning surface (18) of a foundation (2), which post has, in the longitudinal direction, a bending stiffness which is constant or varies continuously and/or in steps. The post (3) is provided with a stiff and/or hard and/or sharp accessory (4,13), a top boundary (8) of which is located above the part of the post which is to be positioned at the level of the positioning surface of the foundation.

Fig 1



EP 1 741 832 A1

Description

[0001] The invention relates to a traffic-safe pillar which has a reduced resistance to collisions and comprises a post to be anchored with respect to a positioning surface of a foundation, which post has, in the longitudinal direction, a bending stiffness which is constant or varies continuously and/or in steps.

[0002] A pillar of this type is known and is used for many different purposes. It is known to use pillars for street lighting, traffic signs, traffic lights and the like. The pillar has to be sufficiently strong to be able to withstand normally occurring loads, such as static loads and wind loads. These requirements affect the strength and stiffness of the pillar, which have to meet specific minimum requirements in order to prevent the pillar from collapsing under the normally occurring abovementioned loads or vibrations and the like.

[0003] These requirements are at odds with traffic safety. Usually, the pillars are in general positioned immediately next to a carriageway, with the result that vehicles coming off the carriageway for any reason may collide with the pillar. It is exactly in these cases that it is desirable for the pillar not to be excessively strong and stiff, but rather for it to provide a reduced resistance to collisions. Such a reduced resistance is very desirable in order to prevent excessive deceleration of the colliding vehicle to such a degree that injuries to the vehicle occupants can be limited. However, in practice, it appears that the known pillars are not able to satisfy this requirement, and instead fold themselves around the colliding vehicle, as it were. The bottom part of the pillar ends up under the vehicle, while the top part of the pillar, as a result of the inertia, folds backwards over the top of the vehicle. In this deformed state, the folded pillar has a considerable retaining action on the vehicle, leading to significant deceleration of the vehicle and thus to a high risk of injuries to the occupants. At relatively high speeds, the entire pillar may eventually be pulled out of the ground by the colliding vehicle or crack in an uncontrolled manner at an arbitrary position.

[0004] A pillar which attempts to reconcile these contradictory requirements in such a way that, on the one hand, it can withstand the loads occurring under normal circumstances and yet, on the other hand, can provide a reduced resistance to substantially transversely directed loads occurring during a collision, is known from Dutch Patent Application 7.311.469. This known pillar has a hollow post to which a number of reinforcing rods running in the longitudinal direction are attached. If a local, transversely directed load on the post exceeds a specific threshold value, the connection between the rods and the post has to be severed so that the post is able to yield. However, it is a drawback of this known pillar that it is difficult to produce. In particular, it is not readily possible to make conventional pillars safer in the event of an impact by using this method.

[0005] It is therefore an object of the invention to pro-

vide a traffic-safe pillar which can be produced in a simple manner. It is also an object for conventional pillars to be made safe to traffic in a simple manner. This object is achieved by providing the post with a stiff and/or hard and/or sharp accessory, a top boundary of which is located above the part of the post which is to be positioned at the level of the positioning surface of the foundation.

[0006] With a pillar which is provided with an insert in this manner, this results in the pillar not so much folding, but rather cracking. After all, during a collision, the insert will apply highly concentrated loads on parts of the post which are diametrically opposite one another, in any case in the collision direction, which initiate cracks and ultimately cause the post to split into two parts. Consequently, the decelerating action on the vehicle can be appreciably reduced, as the loop shape, whereby, with the known mast, the vehicle was initially anchored to the ground by the part of the pillar which was still stuck in the ground, can largely be prevented.

[0007] The relatively stiff or hard insert forms an abrupt transition in the stiffness profile, in particular in the bending stiffness profile of the pillar, which leads to an initial bending or deflection at this transition in stiffness, causing the cracking or breaking of the pillar. As the insert is at such a height that, for example, the bumper of the vehicle can hit it, the desired state of deformation is always ensured. To this end, the insert has to be at the desired level above the positioning surface for the post, such as ground level, a bridge deck and the like.

[0008] In the event of a collision, therefore, a deformation will be initiated at the location of the contact between the insert, in particular the abovementioned boundary thereof, in the wall, leading to the collapse of the pillar. Another advantage is the fact that a conventional pillar can be made safer in the event of an impact in a simple and inexpensive manner by applying the insert thereto. No further modifications of the post, such as for example the provision of weakened sections or the like, are necessary.

[0009] The height over which the insert extends inside the post can be limited. The position of the bottom boundary of the insert can also be varied. According to a first possible preferred embodiment, the bottom boundary of the accessory is at a higher level than the part of the post which is to be positioned at the level of the positioning surface of the foundation. In this embodiment, the entire insert is thus above the positioning surface. In this case, there are two abrupt transitions in stiffness in the pillar, i.e. one at the top boundary and one at the bottom boundary of the insert. The main advantage of this variant is that the post breaks in a very reliable manner, so that the entire insert is forced out of the pillar in the event of a collision, resulting in the creation of a considerable weakened section.

[0010] Preferably, in the normal state, the insert is clear from the internal surface of the post, at least at the boundary or boundaries. This offers the advantage that fatigue of the post is prevented. In practice, slight elastic defor-

mations occur in the post, under the effect of a variety of loads, but in particular as a result of the wind load, which could lead to signs of fatigue in the post if the insert is clamp-fitted. Keeping the boundaries at a distance from the internal surface of the post prevents the post from still coming into contact with the stiff insert in such a manner, and premature initiation of crack-formation is avoided.

[0011] According to a further embodiment, therefore, it may be provided that the bottom boundary of the accessory is located near the part of the post, which is to be positioned at a level above the positioning surface of the foundation, which approximately corresponds to the level at which a bumper or another colliding part of a passenger vehicle is positioned above a road surface. In particular, the bottom boundary of the accessory may be located at a distance above the part of the post which is to be positioned at a level above the positioning surface of the foundation which is equal to 200 to 600 mm. More particularly, the bottom boundary of the accessory may be located at a distance above the part of the post which is to be positioned at a level above the positioning surface of the foundation which is equal to 300 to 500 mm. In particular, the bottom boundary of the accessory may be located at a distance of approximately 400 mm above the positioning surface of the foundation. These heights are matched to the levels at which the bumpers and the like of road vehicles may be located.

[0012] However, it is not always necessary for the bottom boundary of the insert to be above the positioning surface of the pillar. According to a variant, the accessory may therefore extend to below the level of the positioning surface of the foundation.

[0013] The position of the accessory may be varied further; according to a first alternative, the accessory may be arranged in the interior of the post. In that case, the accessory is provided with a bore extending in the longitudinal direction for the passage of ducts. According to a further variant, the accessory may be arranged on the exterior of the post. In particular, the accessory may in that case extend entirely around the post. The advantage of this variant is that the accessory can readily be retro-fitted to pillars which have already been positioned. Thus, it is for example possible to render a road or motorway safer by fitting the accessory according to the invention to the pillars positioned next to the former.

[0014] In order to achieve the desired crack formation upon collision, the accessory may be provided with projections which are directed at a surface of the post. Furthermore, a boundary of the accessory, which boundary is situated at a higher level than the part of the post which is to be positioned at the level of the positioning surface, may comprise a sharp edge suitable for initiating crack formation in the post upon collision load. An insert of this type can be produced in a simple manner, for example by extrusion, from aluminium.

[0015] The post which is used with the pillar according to the invention may be made from aluminium in the usual

way. However, the invention can also be applied to posts consisting of a different material, for example plastic. The insert itself does not have to be made from aluminium or steel either, but may, for example, be made from a reinforced, rigid plastic, such as a fibre-reinforced plastic material.

[0016] The invention furthermore relates to a method for causing a pillar to collapse in a controlled manner, as described above, comprising the following steps:

- anchoring the post with respect to the positioning surface of a foundation,
- providing the post with a stiff and/or hard and/or sharp accessory, a top boundary of which is situated above the positioning surface of the foundation,
- causing a vehicle to collide with the post,
- causing the accessory and the post to interact strongly with one another under the effect of the colliding vehicle,
- causing the post to crack under the effect of the strong interaction with the accessory.

[0017] Causing the post to crack in such a manner that it breaks in a controlled manner and is not able to apply any great deceleration forces on the colliding vehicle, may be effected, for example, by collision forces occurring between the accessory and the post. These collision forces are the result of the collision energy of the road vehicle. In addition, or alternatively, the cracking of the post in a controlled manner may be effected by cutting forces being applied to the post at the location of a sharp part of the accessory as a result of the collision energy from a road vehicle. In this case, the accessory may even be forced out of the post altogether.

[0018] The invention will now be described in more detail with reference to the exemplary embodiments illustrated in the figures below, in which:

Fig. 1 shows a partially cut-away side view of a traffic pillar placed in the ground with an insert according to the invention.

Fig. 2 shows the traffic pillar with an insert in cross section.

Figs. 3a to 3b show some alternative embodiments of the insert.

Fig. 4 shows a detail of the traffic pillar and the insert in cross section, at the location of the top boundary of the insert.

Fig. 5 shows a second variant of the pillar according to the invention.

Fig. 6 shows a third variant.

Figs. 7a-c show variants of the view along VII-VII from Fig. 6.

Fig. 8 shows a fourth variant.

[0019] Fig. 1 shows a pillar 1 comprising a hollow tube 3 anchored in the ground 2. An insert 4 is placed inside the hollow tube 3. The top boundary 8 of the insert is at

a distance h above ground level. This top boundary 8 defines a spot where the post wall will collapse in the event of a collision by crack formation. The spot where crack formation occurs is thus slightly above the positioning surface of the pillar, such as ground level or a bridge deck, but not above the area where a colliding vehicle will hit the pillar. The insert 4 extends to below ground level, so that there is only one stiffness transition above ground level. The insert 4 illustrated is fixedly connected with respect to the tube 3 by means of fastening means 5, for example in the form of bolts, welds, an adhesive joint and the like. However, the bottom side of the insert 4 can also rest on the bottom side of the post 3 on the ground material or be provided with a cable on the top side by which it is suspended inside the post 3. If desired, the insert 4 may be securely clamped inside the post 3. However, it is advantageous if the insert 4 does not under any circumstances touch the top boundary 8 of the post wall during normal use, so that signs of fatigue are prevented.

[0020] Fig. 2 shows the pillar containing an insert 4 therein according to the invention in cross section. The insert 4 shown has a number of projections 7 situated around the periphery, the insert 4 having a star-shaped cross section. When the wall of the post 3 touches a projection 7 during a collision, the latter causes very high stresses in the wall of the post as a result of the relatively small contact surface. It is an advantage of the embodiment having a star-shaped cross section that the collapse of the pillar 1 in the event of a collision is less dependent on the angle of impact of the vehicle.

[0021] The diameter of the top boundary 8 of the insert 4, i.e. the abrupt transition in stiffness, is smaller than that of the inner diameter of the post 3 at the insert, which tolerance is indicated by s . During normal use, the wall of the post does not touch the insert 4 at the location of the top boundary 8 of the insert, which state is indicated by a broken line in Fig. 4. However, in the event of a collision, the post 3 will deform and the wall of the post will come into contact with the insert 4. As a result, high stresses occur at the location of the contact spot 20 which crack the material of the post wall, following which the post 3 collapses. The greater the tolerance s , the greater the deformation of the post 3 which is required in order for the post wall to come into contact with the top boundary of the insert 4. Preferably, the tolerance s is relatively small, so that the desired crack formation occurs early on during a collision.

[0022] The insert 4 shown is furthermore provided with a bore 6 for the passage of power supply ducts and the like from the bottom of the post 3.

[0023] Figs 3a to 3c show some alternative embodiments of the insert. The insert 4 shown in Fig. 3a consists of a thick-walled tube without projections, the insert 4 shown in Fig. 3b consists of a prismatic rod having a square cross section and a bore 6, the insert 4 shown in Fig. 3c consists of a prismatic rod having a triangular cross section.

[0024] With the variant of the pillar 1 according to the invention illustrated in Fig. 5, an insert 4 is used of which not only the top boundary 8, but also the bottom boundary 9 are above the level of the ground 2 in which the pillar 1 is placed. In addition, this insert 4 may be constructed from two gear-like shapes 10, 11, which are connected to one another by a connecting piece 12 with a smaller outer diameter. The teeth of these gear-like shapes 10, 11 are, as explained above, positioned at some distance from the internal surface of the post 3 in order to prevent signs of fatigue.

[0025] Fig. 6 shows the variant in which an accessory 13 is used which extends around the pillar 3. This accessory 13 consists of two identical parts 14, 15, Fig. 7 showing the top view of various variants of the accessory 13. The variant according to Fig. 7a has an accessory 13 consisting of two jacket halves 14, 15 which have a smooth interior surface. Preferably, this interior surface is at some distance from the external surface of the post 3. In the variant of Fig. 7b, the jacket halves 14, 15 have internal teeth, which extend in the longitudinal direction of the post 3, more or less like the shape of an internal gearwheel. In the variant of Fig. 7c, each of the jacket halves 14, 15 has three teeth 17 which are evenly distributed.

[0026] The variant of Fig. 8 shows that the external accessory 13 can not only be positioned above the level of the ground 2, but also half underground.

Claims

1. Traffic-safe pillar (1) which has a reduced resistance to collisions and comprises a post (3) to be anchored with respect to a positioning surface (18) of a foundation (2), which post has, in the longitudinal direction, a bending stiffness which is constant or varies continuously and/or in steps, **characterized in that** the post (3) is provided with a with a stiff and/or hard and/or sharp accessory (4, 13), a top boundary (8) of which is located above the part (23) of the post (3) which is to be positioned at the level of the positioning surface (18) of the foundation (2).
2. Pillar (1) according to Claim 1, in which the top boundary (8) of the accessory (4, 13) is at a higher level than the part (23) of the post (3) which is to be positioned at the level of the positioning surface (18) of the foundation (2).
3. Pillar according to Claim 1 or 2, in which the insert (4, 13) is clear from the post (3), at least at the said top boundary (8).
4. Pillar according to one of the preceding claims, in which the bottom boundary (9) of the accessory (4, 13) is at a higher level than the part (23) of the post (3) which is to be positioned at the level of the posi-

tioning surface (18) of the foundation (2).

5. Pillar according to Claim 4, in which the accessory (4) is clear from the post (3), at least at the bottom boundary.
6. Pillar according to Claim 4 or 5, in which the bottom boundary (9) of the accessory (4, 13) is located above the part (23) of the post (3), which is to be positioned at the level of the positioning surface (18) of the foundation (2), which approximately corresponds to the level at which a bumper or another colliding part of a passenger vehicle is positioned above a road surface.
7. Pillar according to Claim 6, in which the bottom boundary (9) of the accessory (4, 13) is located at a distance of from 200 to 600 mm above the part (23) of the post (3) which is to be positioned at the level of the positioning surface (18) of the foundation (2).
8. Pillar according to Claim 6 or 7, in which the bottom boundary (9) of the accessory (4, 13) is located at a distance of from 300 to 500 mm above the part (19) of the post (3) which is to be positioned at a level above the positioning surface (18) of the foundation (2).
9. Pillar according to Claim 6, 7 or 8, in which the bottom boundary (9) of the accessory (4, 13) is located at a distance of approximately 400 mm above the part (19) of the post (3) which is to be positioned at a level above the positioning surface (18) of the foundation (2).
10. Pillar according to Claim 1, 2 or 3, in which the accessory (4, 13) extends to below the part (23) of the post (3) which is to be positioned at the level of the positioning surface (18) of the foundation (2).
11. Pillar according to one of the preceding claims, in which the accessory (4) is arranged in the interior of the post (3).
12. Pillar according to Claim 11, in which the accessory (4) is provided with a bore (6) extending in the longitudinal direction for the passage of ducts.
13. Pillar according to one of Claims 1-10, in which the accessory (13) is arranged on the exterior of the post (3).
14. Pillar according to Claim 13, in which the accessory (13) extends around the post (3).
15. Pillar according to one of the preceding claims, in which the accessory (4, 13) is provided with projections (7, 16, 17) which are directed at a surface of

the post (3).

16. Pillar according to one of the preceding claims, in which a boundary (8) of the post (3) which is situated at a higher level than the part (23) of the post (3) which is to be positioned at the level of the positioning surface (18) of the foundation (2) comprises a sharp edge or sharp points (20) suitable for initiating crack formation in the post (3) upon collision load.
17. Pillar according to one of the preceding claims, in which a recess (22) is provided in the post (3) which can be closed by means of a lid (21), and the accessory (4, 13) is at a lower level than the bottom boundary of the recess (22).
18. Road, comprising a carriageway and a shoulder, in which a pillar according to one of the preceding claims has its foundation, which pillar comprises a post (3) which has, in the longitudinal direction, a bending stiffness which is constant or varies continuously and/or in steps, **characterized in that** the post (3) is provided with a stiff accessory (4, 13), a top boundary (8) of which is located above the surface (18) of the shoulder (2).
19. Road according to Claim 18, in which the top boundary (8) of the accessory (4, 13) is at a higher level than the surface (18) of the shoulder (2).
20. Road according to Claim 18 or 19, in which the bottom boundary (9) of the accessory (4, 13) is at a higher level than the surface (18) of the shoulder (2).
21. Road according to Claim 18, in which the accessory (4, 13) extends to below the surface (18) of the shoulder (2).
22. Bridge or fly-over, comprising a carriageway and a shoulder extending next to the carriageway and in which a pillar according to one of Claims 1-17 has its foundation, which pillar comprises a post (3) which has, in the longitudinal direction, a bending stiffness which is constant or varies continuously and/or in steps, **characterized in that** the post (3) is provided with a stiff accessory (4, 13), a top boundary (8) of which is located above the surface (18) of the shoulder (2).
23. Bridge or fly-over according to Claim 22, in which the top boundary (8) of the accessory (4, 13) is at a higher level than the surface (18) of the shoulder (2).
24. Bridge or fly-over according to Claim 22 or 23, in which the bottom boundary (9) of the accessory (4, 13) is at a higher level than the surface (18) of the shoulder (2).

25. Bridge or fly-over according to Claim 22, in which the accessory (4, 13) extends to below the surface (18) of the shoulder (2).
26. Method for causing a pillar according to one of Claims 1-17 to collapse in a controlled manner, which pillar has a reduced resistance to collisions and comprises a post (3) which post has, in the longitudinal direction, a bending stiffness which is constant or varies continuously and/or in steps, comprising the following steps:
- anchoring the post (3) with respect to the positioning surface (18) of a foundation (2),
 - providing the post (3) with a stiff and/or hard and/or sharp accessory (4, 13), a top boundary (8) of which is situated above the positioning surface (18) of the foundation (2),
 - causing a vehicle to collide with the post (3),
 - causing the accessory (4, 13) and the post to interact strongly with one another under the effect of the colliding vehicle,
 - causing the post (3) to crack under the effect of the strong interaction with the accessory.
27. Method according to Claim 26, comprising causing the accessory (4, 13) and the post (3) to interact strongly with one another by collision forces acting between them.
28. Method according to Claim 26, comprising causing the accessory (4, 13) and the post (3) to interact strongly with one another by cutting forces acting between them at the location of a sharp part of the accessory (4, 13).
29. Method according to one of Claims 26-28, comprising causing the accessory (4, 13) and the post (3) to interact so strongly with one another that the accessory is forced out of the post.

45

50

55

Fig 1

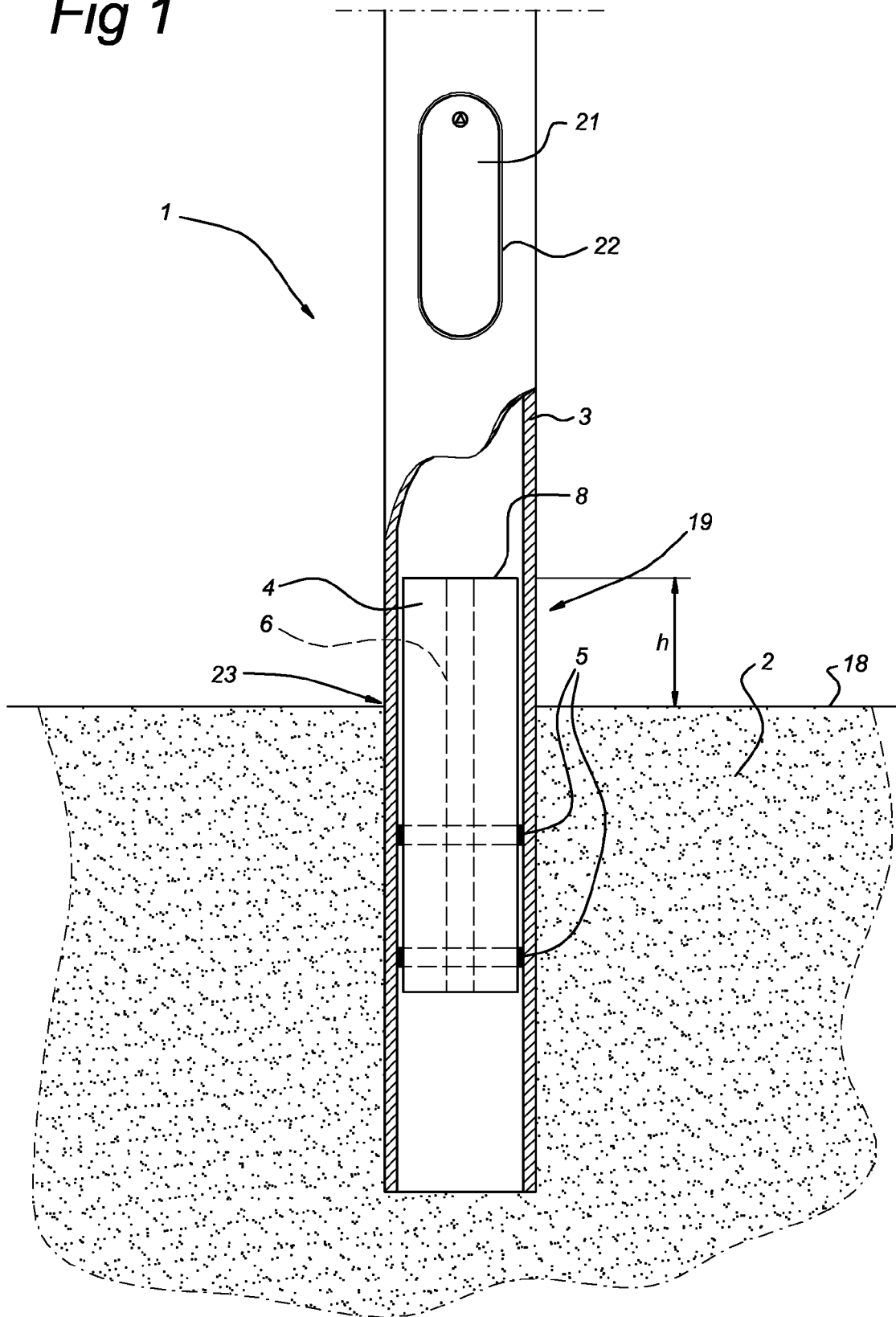


Fig 2

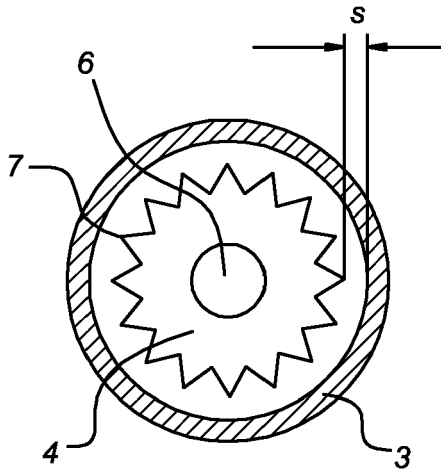


Fig 3a

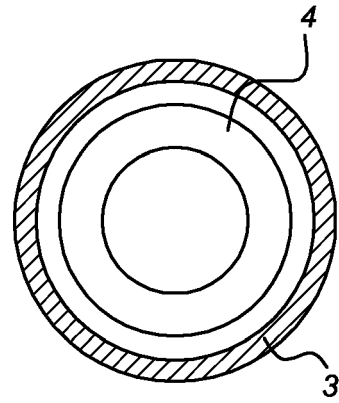


Fig 3b

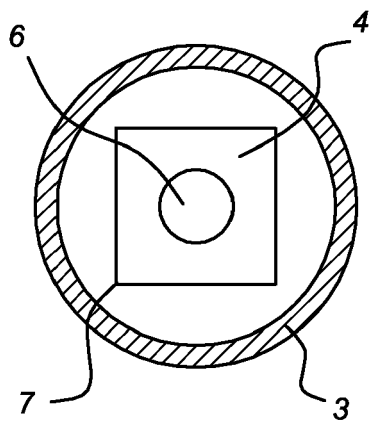


Fig 3c

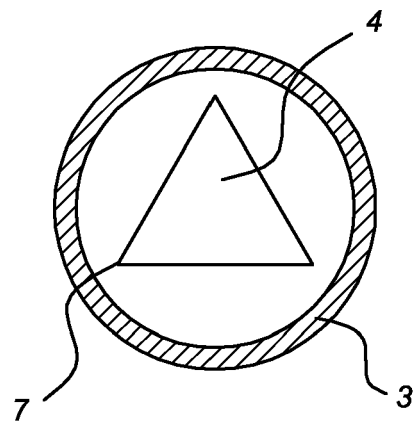


Fig 4

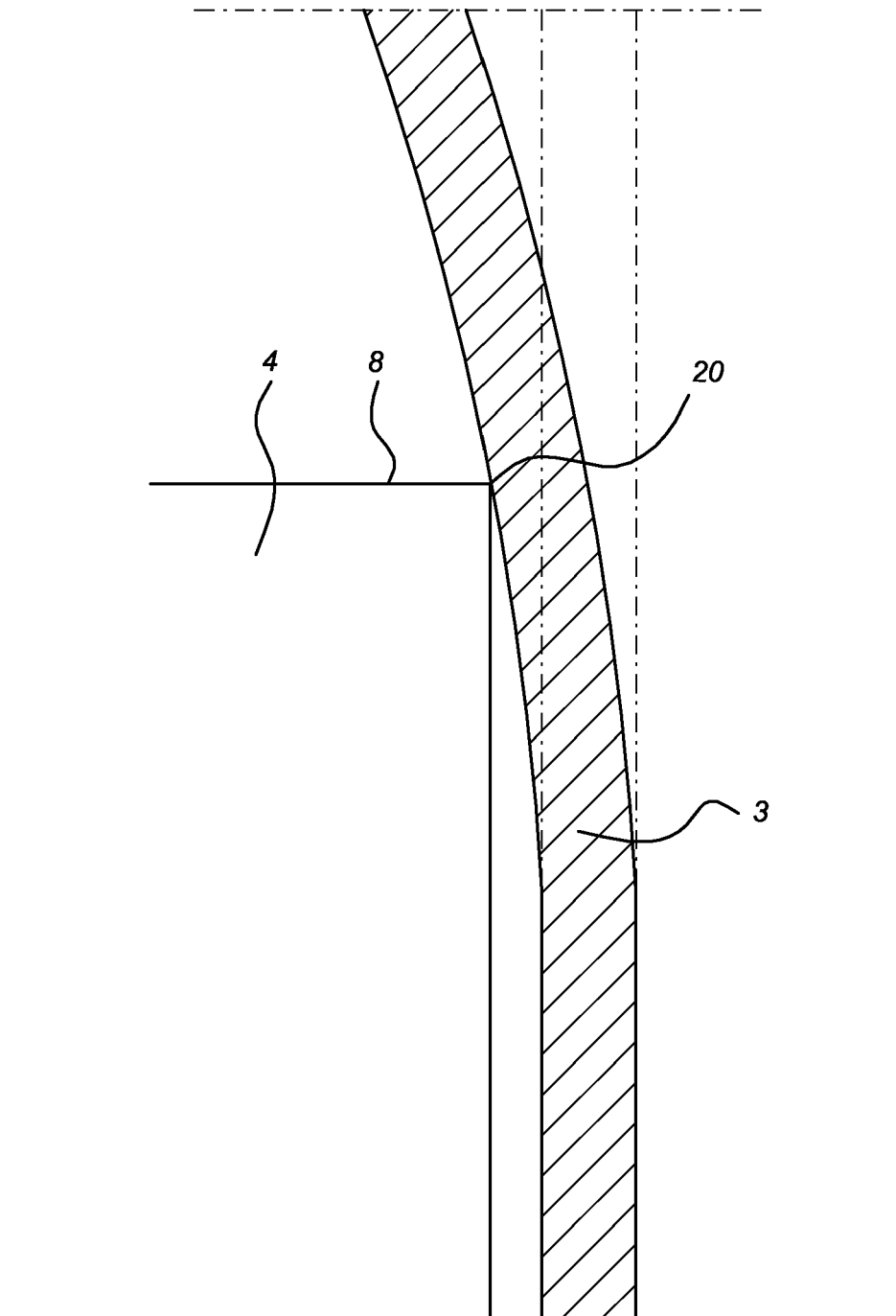


Fig 5

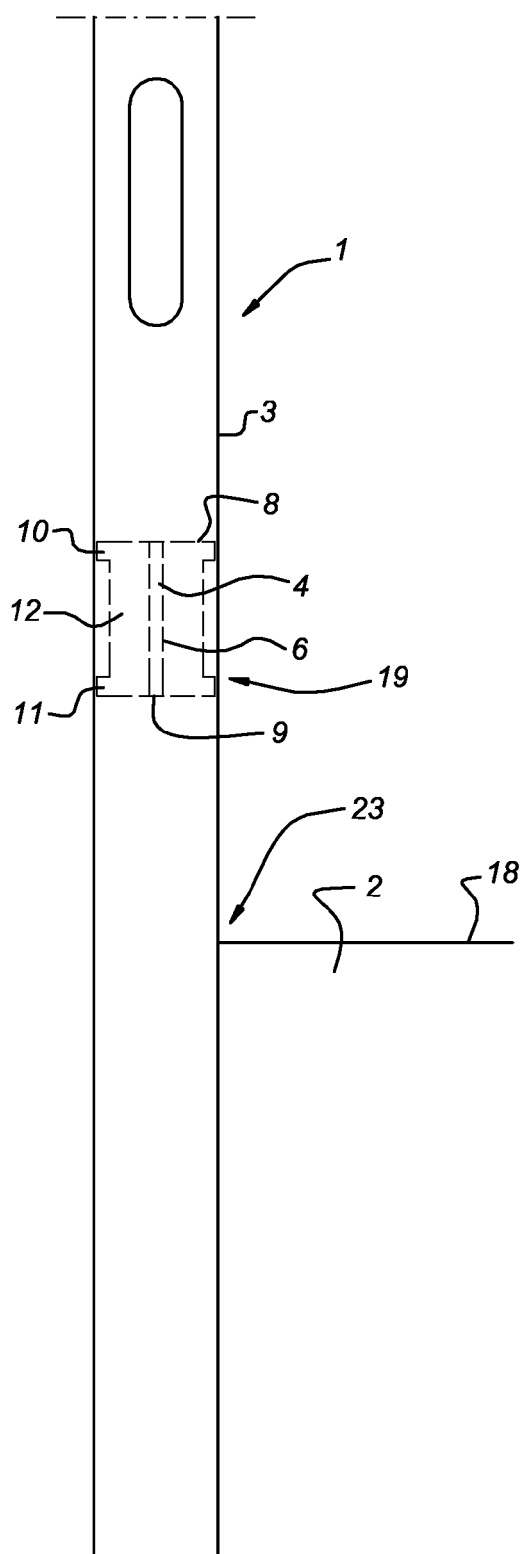


Fig 6

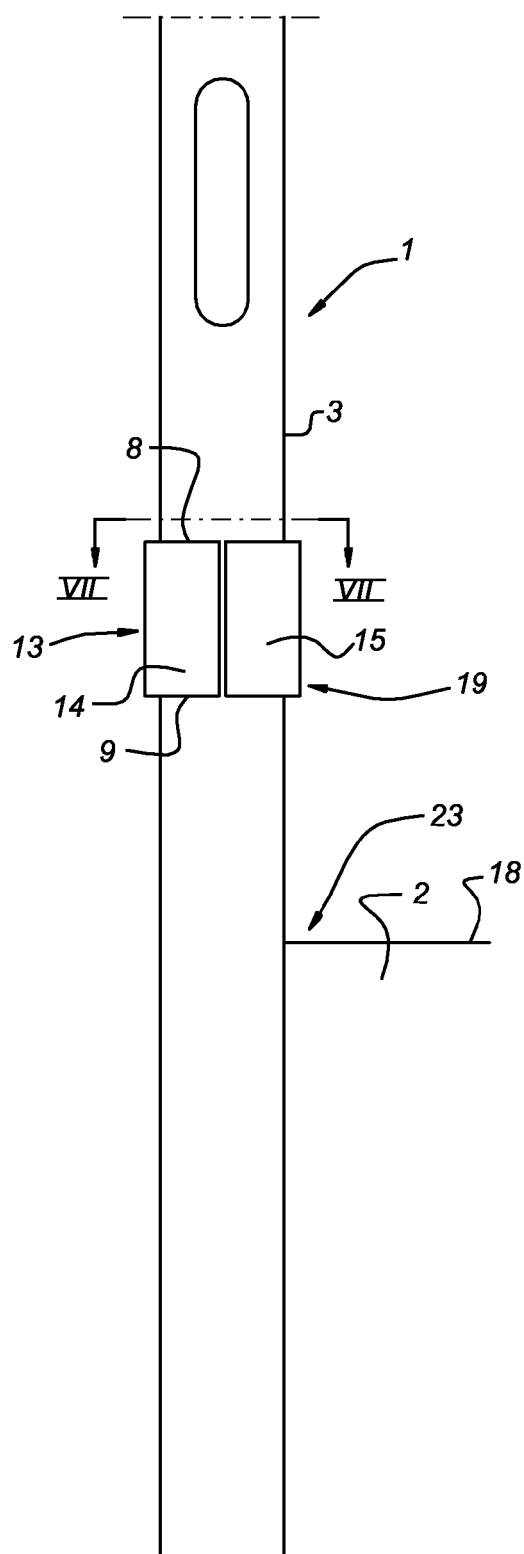


Fig 8

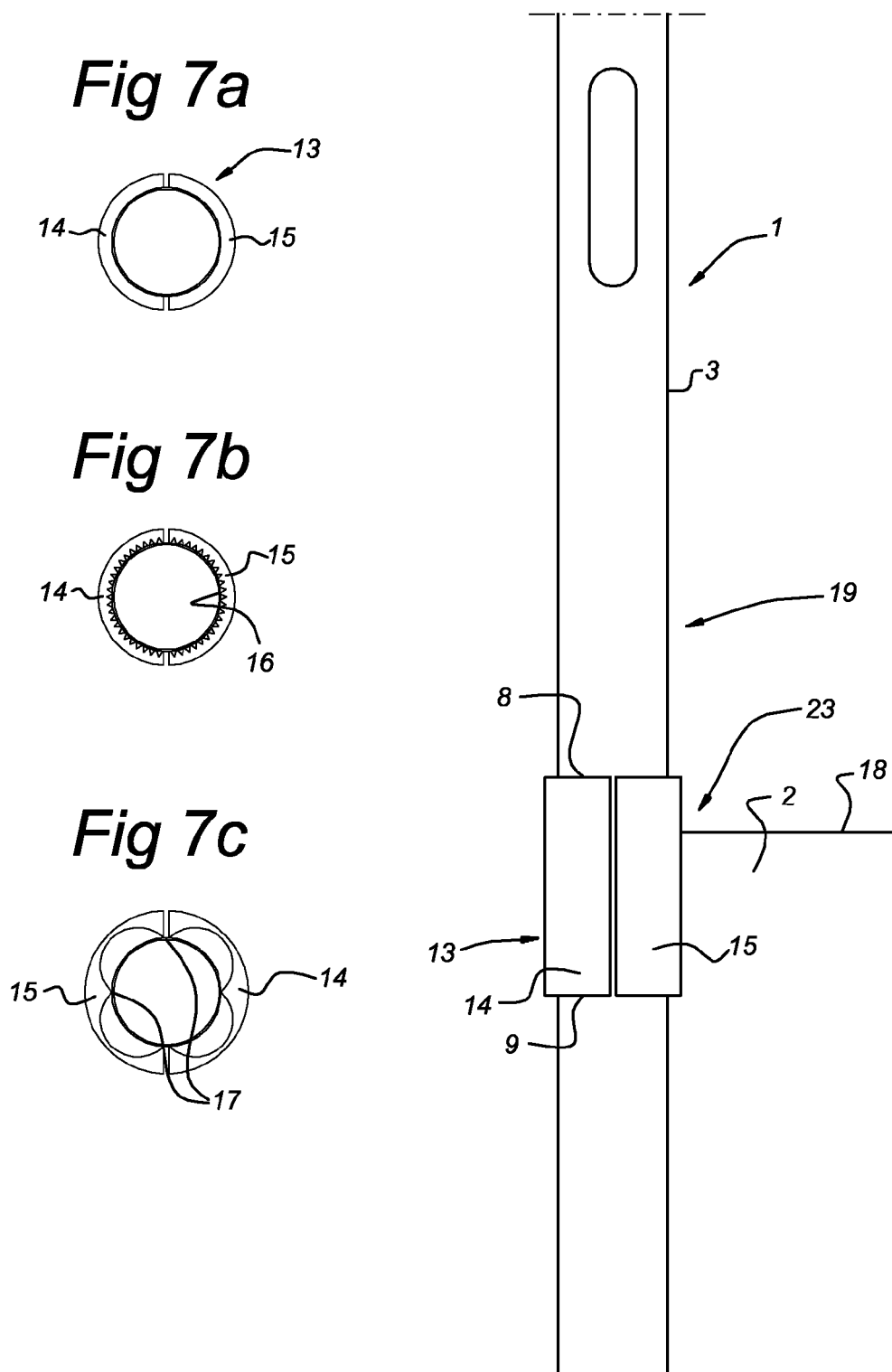
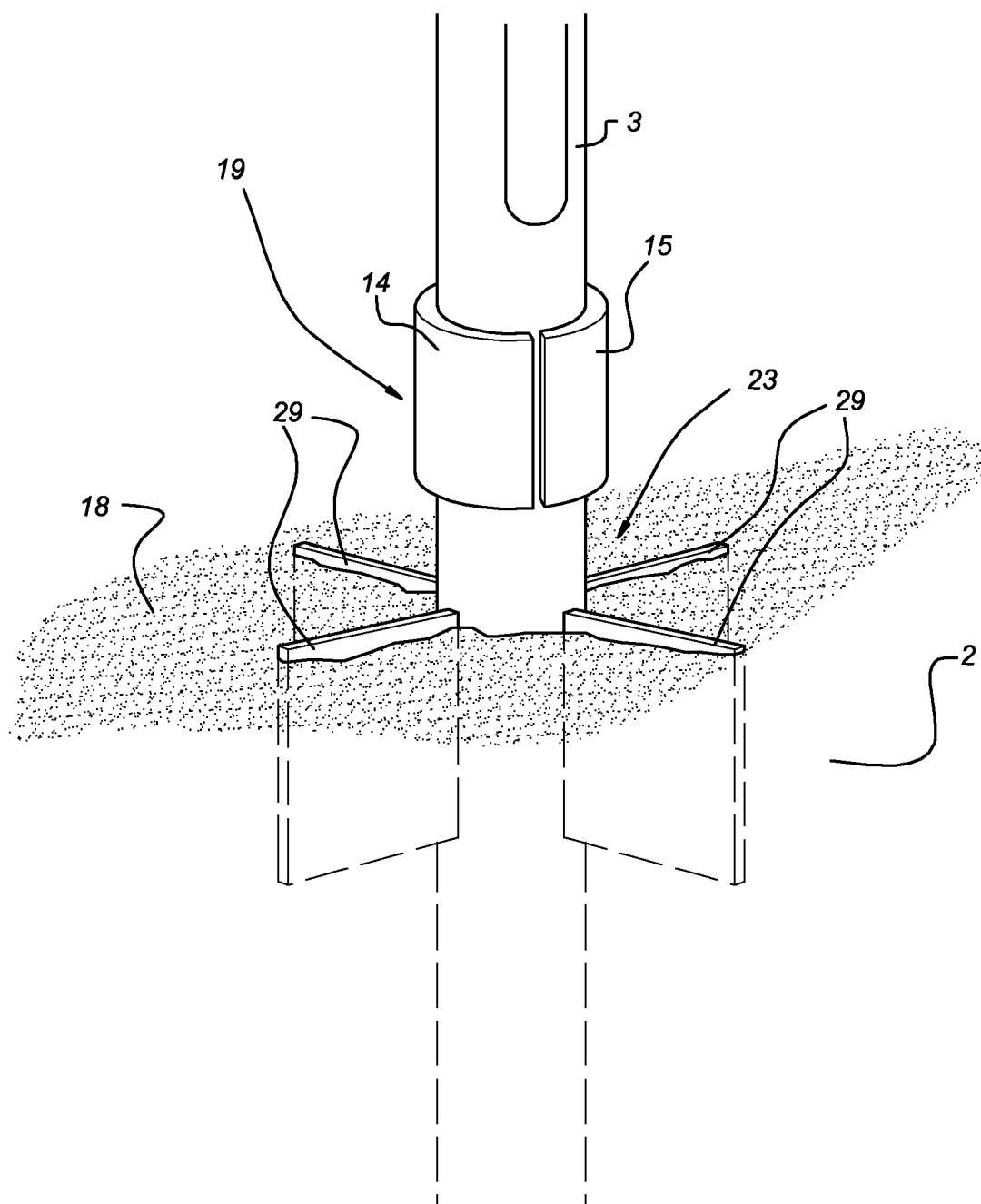


Fig 9





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 616 818 A (LAPORTE ETS A) 23 December 1988 (1988-12-23)	1-3, 7-12, 16-29	INV. E01F9/018
Y	* page 2, line 22 - page 3, line 29; figures 2-4 *	15	
X	----- US 4 522 530 A (ARTHUR W EUGENE [US]) 11 June 1985 (1985-06-11) * the whole document *	1-3, 10-12,16	
X	----- EP 0 049 726 A1 (PLYM OSCAR WILHELM) 21 April 1982 (1982-04-21) * the whole document *	1,2,4-6, 13,14, 26-29	
X	----- GB 2 396 180 A (* MALLATITE LIMITED) 16 June 2004 (2004-06-16) * page 5, paragraph 3 - paragraph 4 * * page 6, paragraph 3 - page 7, paragraph 1; figures *	1-3,6	
Y	----- DE 22 27 661 A1 (WOLF, MANFRED, 4190 KLEVE) 20 December 1973 (1973-12-20) * page 4, paragraph 3 - page 5; figure *	15	TECHNICAL FIELDS SEARCHED (IPC) E01F E04H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 October 2006	Examiner Geivaerts, Dirk
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 11 6698

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-10-2006

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2616818	A	23-12-1988	NONE	
US 4522530	A	11-06-1985	NONE	
EP 0049726	A1	21-04-1982	AT 11064 T DE 3069911 D1	15-01-1985 14-02-1985
GB 2396180	A	16-06-2004	NONE	
DE 2227661	A1	20-12-1973	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- NL 7311469 [0004]